Mathematical formulation of the FSM

(*In alphabetical order*)

abandoned gavias=INTEG (abandonment-permanent abandonment-newirrig-gavias restoration,GAV ABAND INIC)

Area covered by abandoned gavias. Units: ha

abandonment=active gavias*GCR

Change on abandoned gavias. Units: ha/Year

ABROAD=0.74

Proportion of tourists arrived from abroad (Source: ISTAC). Units: Dmnl

accomodation ch=IF THEN ELSE(ch or>0:AND:or-1>THRESHOLD OR, tourist accommodation capacity *AIR*rem new accommod, 0)

Change in the number of bed in tourist accommodation. Units: bed/Year

accomodation effect=maturity factor*potential accomodat effect

The effect that the new accommodations have on the Fuerteventura attraction factor. Units: Dmnl

active crops=irrigation+active gavias

Area covered by the total active crops. Units: ha

active gav prop=active gavias/MAX GAVIAS

Active gavias proportion. Units: Dmnl

active gavias=INTEG (gavias restoration-abandonment, INIT GAVIAS)

Area covered by active gavias. Units: ha

adjustable runoff=ARC*runoff

Adjustable runoff. Units: m3/Year

AIR=0.18988

Accomodation increase ratio (Source: AC). Units: 1/Year

annual vol gav reuse=reus vol-irrigation reus vol

Annual volumen of reclaimed water for gavias restoration. Units: m3/Year

ARC=0.367

Adjustable runoff constant . Units: Dmnl

artificial land proportion=artificial land/FV area ha

Proportion of modified land. Threshold: 20% sustainability (Graymore et al. 2010). Units: Dmnl

artificial land=roads area+tracks area+nonhoteland+hoteland+golf courses+residential+irrigation

Artificial (modified) land. Units: ha

at landscape indicator=(nat high quality calidad+active gavias)/artificial land

Atraction landscape indicator. Units: Dmnl

available surface water=surface discharge-EVAPORATION+irrigation reus vol

Available surface water. Units: m3/Year

AVERGOODS=1.22027e+009

Average value of the Sea transportation of goods (kg) (Source: ISTAC). Units: kg/Year

AVERSTAY=9.06

Average lenght of the stay (Source: INE). Units: days

B=33.2455

Intercept from regression between births and GDPca. Units: Dmnl

beach m2 2015=beach*scn spill

Beach surface available after 2010. Units: m2

beach m2=IF THEN ELSE(Time<2015,beach,beach m2 2015)

Beach area. Units: m2

beach pc factor=lookup beach pc(i beach pc)

Units: Dmnl

beach pc=beach m2/total population

Available beach per capita. Units: m2/inhab

beach=6.51589e+006

Available beach area (litoral strip of 100m). Units: m2

BIR BASE=-0.018767

Factor from regression between births and GDPca. Units: 1/Year

bir=exp time*GDPca NORMALIZED

Birth rate. Units: 1/Year

births=resident population*bir

Births. Units: inhab/Year

bov demand=n bov*TCONPORC

Water demand by by bovine cattle. Before AS demanda bov=(n bov*TCONBOV). Units: m3/Year

bov rate=-6.83

Change on the number of cows rate. Units: head/Year

bov2012=INTEG (bov rate, 209)

Number of cows after 2012 (for scenarios).Units: head

brine production=(1-SEADES CONVR)*(urban desal demand/SEADES CONVR)

Brine production. Units: m3/Year

built urban=residential+hoteland+nonhoteland+golf courses

Urban built up area. Units: ha

CFBUEU=3.37

Factor of urban built up which affects the houbara habitat. Units: Dmnl

CGc=goat and sheep cattle*Lug

Goat and sheep cattle (expresed as LU). Units: LU

CGcpast=MAX((CGc-potential stocking rate reduction)*NGP,0)

Grazing goat and sheep cattle. Units: LU

CGcpast1=DELAY FIXED (CGcpast, 1, 5120)

Delayed grazing goat and sheep cattle. Units: LU

cgfodproduction=pasture and fodder production/TINGCAPROV

Stocking rate capacity in gavias. Units: head

cgpastac=CGcpast*fac

Goat and sheep cattle which graze in the high quality natural vegetation proportion of the grazeable area. Units: LU

ch aband gavias=abandonment-newirrig-gavias restoration-permanent abandonment

Change on abandoned gavias. Units: ha/Year

ch employ=(tourist employment-delayed employment)/delayed employment

Annual change on the employment. Units: Dmnl

ch hab sec gav=-HCRac*ch aband gavias

Change on the secondary habitat due to changes on the abandoned gavias. Units: ha/Year

ch or=or-1-or-2

Change on the occupancy rate between last year and the previous one. Units: inhab/bed

change HS=loss HSHtracks+loss HSHroads+loss HSHbu+ch hab sec gav-chHSpermabandon

Change on the secondary habitat. Units: ha/Year

change in desalinated water SCNfod=(MAX(total water needs-water total crop,0))*TEXIT

Change on water which will be deslated each year. Units: m3/Year/Year

change nonhot=nonhotel accommodation-delayed nonhot

Change in non hotel accomodations. Units: bed/Year

chGDPca=INTEG (GDPca rate,0)

Change on the GDPca. Units: Dmnl

chHPHpermabandon=HPH prop*HCRpermabandon*permanent abandonment

Houbara Primary Habitat gainance due to the new natural schrub after the permanent abondement. Units: ha/Year

CLIM=0

Climate change scenario activator. Units: Dmnl

CO2 balance=CO2 emission vehicles fleet+CO2 visitors+CO2 ships+CO2balance gavias+CO2balance golf+CO2balance irrigation+CO2balance natural vegetation+Indirect emission of generated waste+Indirect emissions of electricity consumption

Total balance of CO2 in Fuerteventura island. Units: g CO2/Year

CO2 emission vehicles fleet=(demand E transport*DVEF)+(demand E transport*GVEF)

CO2 emissions from vehichles fleet. Units: g CO2/Year

CO2 per capita=CO2 balance/total population

Per capita CO2 emissions. Units: g CO2/(Year*inhab)

CO2 ships=SCO2E*SFCF desglosado*ships

CO2 emissions from ships. Units: g CO2/Year

CO2 transport=CO2 visitors+CO2 ships+CO2 emission vehicles fleet

CO2 from Transport sector. Units: g CO2/Year

CO2 visitors=FCO2E*energy used flights

CO2 emissions related to the energy consumed on flights. Units: g CO2/Year

CO2balance gavias=CO2FACTORgav*(active gavias+(fodder scn area*FPgav))

CO2 factor for gavias. Units: g CO2/Year

CO2balance golf=CO2FACTORgc*golf courses

CO2 factor for golf courses. Units: g CO2/Year

CO2balance irrigation=CO2FACTORirrig*(irrigation+(fp irrig*fodder scn area))

CO2 factor for irrigated areas. Units: g CO2/Year

CO2balance natural vegetation=natural total*NEEevolution

Balance (flow) CO2 emision-sequestration from natural vegetation. Units: g CO2/Year

CO2FACTORgav=-300000

CO2 factor for gavias. Units: g CO2/(Year*ha)

CO2FACTORgc=-6.46e+006

CO2 factor for golf courses. (Source: Muñoz-Rojas et al. 2011). Units: g CO2/(Year*ha)

CO2FACTORirrig=-5e+006

CO2 factor for irrigation. (Source: derived from Muñoz-Rojas et al. 2011). Units: gCO2/(Year*ha)

CPRE=0.0008224

Rainfall coefficient. Units: LU/(ha*mm)

DAYS A YEAR=365

Units: days/Year

deaths=MOR*resident population

Death rate. Units: inhab/Year

deficit hq=IF THEN ELSE(hq area required- nat high quality >0, hq area required- natl high quality vegetation, 0)

Deficit of hectares of high quality natural vegetation required by the grazing needs. Units: ha

degra nthq proportion=degradation hq notrans/(nat hq notrans*OVERGRAZING RATIO)

Degradation of the non transformable high quality natural vegetation proportion. Units: Dmnl

degra thq proportion=degradation hq trans/(nat hq trans*OVERGRAZING RATIO)

Degradation of the transformable high quality natural vegetation proportion. Units: Dmnl

degradation hq notrans=MIN(nthq prop*p deficit hq*OVERGRAZING RATIO,nat hq notrans*OVERGRAZING RATIO)

Degradation of the non transformable high quality natural vegetation caused by overgrazing. Units: ha/Year

degradation hq trans=MIN(thq prop*p deficit hq*OVERGRAZING RATIO,nat hq trans*OVERGRAZING RATIO)

Degradation of the transformable high quality natural vegetation caused by overgrazing. Units: ha/Year

delay beach pc facto=DELAY FIXED (beach pc factor, 1, 1)

Units: Dmnl

delayed employment=DELAY FIXED (tourist employment, 1, REFERENCE EMPLOYMENT)

Units: emp

delayed nonhot=DELAY FIXED (nonhotel accommodation,1,24836.5)

Non hotel accommodation delayed. Units: bed/Year

demand E des=(IF THEN ELSE(Time<2010, TKWM3*urban desal demand , TKWM3*(urban desal demand-desal CORRALEJO)))+requiered energy fodder scn

Electric energy demand for desalination processess. Units: kwh/Year

demand E etp=etp*eecr

Demand of electric energy from the tourist equivalent population. Units: kwh/Year

demand E others=TCEO*pri pop and transp

Demand of electric energy from other sectors. Units: kwh/Year

demand E respop =resident population*eecr

Demand of electric energy from the resident population. Units: kwh/Year

demand E transport=vehicles fleet*TCV

Demand of energy from transportation (by roads). Units: kwh/Year

demand nonel etp=etp*TCNE

Demand of non electric energy from tourist equivalent population. Units:kwh/Year

demand nonel others=TCEOne*pri pop and transp

Demand of non electric energy from other sectors. Units: kwh/Year

demand nonel respop=resident population*TCNE

Demand of non electric energy from resident population. Units: kwh/Year

desal CORRALEJO=1.46e+006

Capacity of the desalination facilities in Corralejo. Units: m3/Year

DVEF=189.6

Diesel vehicles CO2 emission factor. Units: g CO2/kwh

DIST1=316.14

Distance from Gran Canaria by passenger's flights (round trip). Units: km/inhab

DIST2=3234.26

Distance from Madrid by passenger's flights (round trip). Units: km/inhab

DIST3G=6973.66

Distance from Berlin by passenger’s flights (round trip). Units: km/inhab

DIST3UK=5604.92

Distance from London to by passenger’s flights (round trip). Units: km/inhab

DIST4=2291.12

Distance from Puerto de Cádiz to Puerto del Rosario (round trip). Units: km/journey

DOTRPAST=11000

Fodder water requierements. Units: m3/(Year*ha)

ECCG= (LGCC-Egyptian vultures)/LGCC

Egyptian vulture carrying capacity. Units: Dmnl

ECO2E=360

Electricity C02 Emision factor. Units: g CO2/kwh

EECBR=829.495

Population electric energy consumption base ratio, before considering the GPDca effect. Units: kwh/(inhab*Year)

eecr=effect chGDPca*EECBR

Population electric energy consumption Ratio (once the effect of GDPca has been considered). Units: kwh/(inhab*Year)

efec clim=0.9

Coefficient of rainfall for Climate change scenarios. Units: Dmnl

efect reut=(MIN(fodder scn area,potential new active gavias))*TREUG

Effect of the reclaimed water for gavias restoration. Units: ha/Year

effect chGDPca=initial factor evoGDP+chGDPca

Effect of the change on GDPca on energy consumption. Units: Dmnl

effect new built up urb=CFBUEU*new built urban

Effect of the new built up urban on the houbara habitat. Units: ha/Year

effective urban desalinated seawater consumption=MIN(SEADESCAP, urban desal demand

Effective urban desalinated seawater consumption. Removed from the model structure after the OAT. Units: m3/Year

EFLGCC=CGcpast1*Elgcc

Effect of the livestock on the Egyptian vulture carrying capacity. Units: ev

Egyptian vult prop=Egyptian vultures/REF Egyptian vult

Proportion of Egyptian vultures regarding the reference value. Units: Dmnl

Egyptian vultures=INTEG (inc ev-nonat death Ev, 113)

Egyptian vultures population. Units: ev

EICF=2

Energy intensity conversion factor. Units: MJ/km

elec E consum=IF THEN ELSE(SAwr=0, demand E des+demand E others+demand E respop+demand E etp, demand E others+demand E respop+demand E etp)

Total electric energy consumption. Units: kwh/Year

eLGCC=0.0215197

Effect of the livestock over the carrying capacity of the Egyptian vulture (AC). Units: ev/LU

emigration=(resident population*temig)

Emigration rate. Units: inhab/Year

employ index=employ ratio*(NORMAL EMPLOY FACTOR+ch employ)

Employment index. Units: Dmnl

employ ratio=(delayed employment/REFERENCE EMPLOYMENT)

Units: Dmnl

energy losses=IF THEN ELSE(SAef=0, TPPbase, TPPbase+RAMP TPP)

Energy losses for scenarios. Units: Dmnl

energy self sufficient index=(tot prim energy-tot pri no renewab)/tot prim energy

Energy self sufficient index. Units: Dmnl

energy used flights= (DIST1*vis1) + (DIST2*vis2) + (DIST3G*vis3*ratioG) + (DIST3UK*vis3*ratioUK))*EICF

Energy use per passenger (one way flights). Units: MJ/Year

etp=iet*INITIAL ETP

Tourist equivalent population. Units: inhab

EVAPORATION=67000

Annual evaporation rate from water reservoirs. Units: m3/Year

EVTo=(EVTp*pre vol m2)

Evapotranspiration. Units: m/Year

EVTp=0.315

Evapotranspiration (after the improvement of model formulation by means of the SA, the model value is 0.315; before this change, the model value was 0.9). Units: Dmnl

exp time=EXP(B+(BIR BASE*Time))

Units: Dmnl/Year

fac=nat high quality / grazeable area

High quality natural proportion on the total grazeable area. Units: Dmnl

FC pre=0.001

Unit conversor. Units: m/(mm*Year)

FCO2E=69

Flights CO2 Emissions (Source: Becken 2002). Units: g CO2/MJ

FCONV=10000

Unit conversor. Units: m2/ha

filling rate=MIN(73684.2, (reservoir capacity*TEXIT))

Annual filling ratio. Units: m3/Year

FLOWSPRINGR=4.8751e-006

Flow spring ratio. Insensitive parameters. Removing from the model structure after OAT. Units: 1/Year

fod consump bov=TINGCAPROV*n bov

Fodder consumption (and other materials) by bovine cattle. Before AS: TINGBOV*n bov. Units: kg/Year

fod consump porc=TINGCAPROV*n porc

Fodder consumption (and other materials) by pig cattle. Before AS: TINGPORC*n porc. Units: kg/Year

fod importation needs=MAX(requiered fodder caprov-fodder consumption supplied by grazing-Fodder needs grazing potential feedlot cattle feed,0)

Potential fodder importation needs. Units: kg/Year

fod need prop=fodder importation needs/(requiered fodder bovporc+requiered fodder caprov)

Proportion of fodder importantion needs, regarding the total needs. Units: Dmnl

fodder consumption supplied by grazing=TINGCAPROV*(real stocking rate reduction/LUg)*NGP

Fodder consumption supplied by grazing under Measure 3.2. Units: kg/Year

fodder desalinated water supply=INTEG (change in desalinated water SCNfod,0)

Annual capacity of desalination for fodder water supply. Units: m3/Year

fodder importation needs=fod importation needs+requiered fodder bovporc

Fodder importation needs. Units: kg/Year

fodder needs grazing=(CGcpast/LUg*TINGCAPROV)

Fodder needs supplied by grazing. Units: kg/Year

fodder scn area=fod importation needs/FODDER YIELD

Area on the island needed to product all the requiered fodder. Units: ha

FODDER YIELD=37705.5

Annual fodder yield (Source: Palacios et al. 2008). Units: kg/(ha*Year)

fp irrig=1-FPgav

Irrigated fodder area proportion. Units: Dmnl

FPgav=0.4

Non irrigated fodder area proportion (average proportion of the ISTAC serie of data). Units: Dmnl

fst=delay beach pc factor*tpi factor*natural landscape indicator

Tourist attraction index. Units: Dmnl

FUEL CONSs=804.812

Fuel consumption of ships by each kilometer. Units: kg fuel/km

FV area ha=172500

Fuerteventura area (hectares). Units: ha

FV area m=1.725e+009

Fuerteventura area (m2). Units: m2

GAV ABAND INIC=3475.68

Initial value. Units: ha

gavias infiltration=IF THEN ELSE((gavias m2*IR gavias)>(gavias m2*EVTo), (gavias m2*IR gavias)-(gavias m2*EVTo),0)

Annual volume from gavias infiltration. Units: m3/Year

gavias m2=FCONV*active gavias

Unit conversor. Units: m2

gavias restoration=MIN(rehab efec,abandoned gavias*TEXIT)

Restoration of gavias. Units: ha/Year

GCR=0.0515523

Gavias abandonment ratio (AC). Units: 1/Year

GDP effect=GDP NORMAL+GDPreal long*MFACTOR GDP

Effect of the GDP of the most important markets for outbound tourism on the tourist choice of destination index. Units: Dmnl

GDP NORMAL=1

Normalized value of GPD index. Units: Dmnl

GDP real

Annual variation of the GDP from the main markets for outbound tourism for Fuerteventura (Data). Units: Dmnl

GDP2012=0

For scenarios activation. Units: Dmnl

GDPca inmig=GDPca NORMALIZED*MF GDPca INMIG

Effect of the Canarian GDP on immigration processes. Units: Dmnl

GDPca inmig-S= DELAY1(GDPca inmig, TINMIGDPca)

Delayed effect of GDPca on inmigration. Units: Dmnl

GDPca long=IF THEN ELSE(Time<2012, GDPca, GDPca+GDPCAN2012)

Long time series of GDPca. Units: Dmnl

GDPca NORMALIZED=GDP NORMAL+GDPca long

Normalized Canarian GDP. Units: Dmnl

GDPca rate=TI GDPca*TEXIT

Change in GDPca. Units: Dmnl/Year

GDPca

Annual variation of the Canarian GDP (Data). Units: Dmnl

GDPcaFACTOR=4240

Effect of the GDPca on sea transportation of goods. Units: ships

GDPCAN2012=0

For scenarios activation. Units: Dmnl

GDPreal long=IF THEN ELSE(Time<2012, GDP real,GDP real+GDP2012)

Long time series of GDPreal. Units: Dmnl

goat and sheep cattle

Number of heads of goat and sheep cattle until 2011 (Data). Units: head/Year

goatsh demand=goat and sheep cattle*TCONCAPROV

Water demand by by goat and sheep cattle. Units: m3/Year

goatsh2012=INTEG (goatsh rate, 149745)

Number of goats and sheeps after 2012 (for scenarios).Units: head

goatsh rate=-85.83

Change on the number of goats and sheeps rate. Units: head/Year

golf courses dem

Annual golf courses demand (Data). Units: golf course/Year

golf courses=INTEG (nat hq golf+nat lq golf,0)

Source: Aerial photointerpretation from GRAFCAM images. Units: ha

golf gross demand=golf net demand+(golf net demand*GOLFLOSR)

Gross water demand by golf courses irrigation. Units: m3/Year

golf land demand=golf courses dem*SCG

Annual golf land demand. Units: ha/Year

golf net demand=GOLFCONR*golf courses

Net water demand by golf courses irrigation. Units: m3/Year

golf reus vol=TOURISTGOLFREUR*tur treat vol

Reused sewage water volume which is destined to golf courses irrigation. Units: m3/Year

GOLFCONR=10950

Golf courses water consumption. Units: m3/(ha*Year)

GOLFLOSR=0.2

Water loss ratio on golf courses. Units: Dmnl

goods=AVERGOODS-(pasture and fodder production*SAp3)

Average value of the Sea transportation of goods (kg). Units: kg/Year

grazeable area=abandoned gavias+natural total

Units: ha

GROUNDWATER INIT=1.035e+010

Initial value. Units: m3

groundwater=INTEG (gavias infiltration+rainfall recharge+irrigat reinfiltrat-gw pumping-VOL FLOW SEA-vol flow spring,GROUNDWATER INIT)

Groundwater volumen. Units: m3

GVEF=95.312

Gasoline vehicles CO2 emission factor. Units: g CO2/kwh

gw pumping=gwp irrig+gwp livestock+gwp urban+gwp golf

Ground water pumping. Units: m3/Year

gwp golf=IF THEN ELSE(golf gross demand>golf reus vol,golf gross demand-golf reus vol,0)

Ground water pumping for golf courses demand. Units: m3/Year

gwp irrig=IF THEN ELSE(irrigation gross demand>available surface water,irrigation gross demand-available surface water ,0)

Groundwater pumping for irrigation demand. Units: m3/Year

gwp livestock=bov demand+goatsh demand+porc demand

Groundwater pumping for livestock demand. Units: m3/Year

gwp rpop=rpop gross demand *RPOPAQUIFR

Groundwater pumping for resident population demand. Units: m3/Year

gwp urban=gwp rpop

Groundwater pumping for urban demand. Units: m3/Year

ha roads=new roads*RATIO ha km ROADS

Roads area (in hectares). Units: ha/Year

ha tracks=new tracks*RATIO ha km TRACKS

Tracks area (in hectares). Units: ha/Year

HCRac=0.966

Houbara habitat change ratio due to active crops. Units: Dmnl

HCRpermabandon=0.178

Houbara habitat change ratio due to permanent abandonment of gavias. Units: Dmnl

HCRroads=15.509

Houbara Habitat Change Ratio due to roads. Units: ha/km

HCRtracks=8.42

Houbara habitat change ratio due to tracks. Units: ha/km

HCRub=0.119

Houbara habitat change ratio per hectare of new urban built up. Units: Dmnl

high quality degradation=degra nthq proportion+degra thq proportion

Degradation of the total high quality natural vegetation proportion. Units: Dmnl

hm3 recharge=tot recharge/hm3

Recharge (hm3). Units: hm3/Year

hm3=1e+006

Unit conversor. Units: m3/hm3

hot land demand=MAX(0,hotel accommod demand*HOTEL ACCOMMODATION LAND DEM)

Hotel land demand. Units: ha/Year

hotel accommod demand=accommodation ch-change nonhot

Hotel accommodation demand. Units: bed/Year

HOTEL ACCOMMODATION LAND DEM=0.0059

Demand of land by each nonhotel accommodation bed (Source: Government of Canary Island 2004). Units: ha/bed

hoteland=INTEG (nat hq hot+nat lq hot,60.9612)

Units: ha

Houb Habitat prop=total houbara habitat/REF houb habitat

Houbara habitat proportion. Units: Dmnl

HPH prop=primary habitat/total houbara habitat

Proportion of the primary habitat regarding the total houbara habitat. Units: Dmnl

HPHinicial=11051

Initial value. Units: ha

HPHLRntracks=HPH prop*HCRtracks

Houbara Primary Habitat loss Ratio per km of tracks. Units: ha/km

HPHLRroads=HPH prop*HCRroads

Houbara Primary Habitat loss Ratio per km of roads. Units: ha/km

hq area required=cgpastac/stocking rate max

High quality natural vegetation area required by the grazing needs. Units: ha

HSH prop=secondary habitat/total houbara habitat

Proportion of the primary habitat regarding the total houbara habitat. Units: Dmnl

HSHinicial=19003.3

Initial value. Units: ha

HSHLRntracks=HSH prop*HCRtracks

Houbara Secondary Habitat loss Ratio per km of tracks. Units: ha/km

HSHLRroads=HCRroads*HSH prop

Houbara Secondary Habitat loss Ratio per km of roads. Units: ha/km

i beach pc=beach pc/NBEACH THRESHOLD

Beach pc Index used in order to normalized the dimmension. Units: Dmnl

ICR=0.00110302

Irrigation change rate (AC). Units: 1/Year

iet=IF THEN ELSE(Time<1997,1+RAMP(-0.201,1996,1997),fst*GDP effect*SHOCKS*accomodation effect*MFACTOR IET)

Tourist choice of destination index. Units: Dmnl

inc ev=MIR*Egyptian vultures*ECCG

Increase on the Egyptian vulture population. Units: ev/Year

inc pobres=respop delay-pobres ret-1

Change on resident population. Units: inhab

inc pop=total population-pobtot ret

Annual increase of population. Units: inhab

Indirect emission of generated waste=USW generation*WCO2E

Indirect emission of generated waste. Units: g CO2/Year

Indirect emissions of electricity consumption=Consumo E elect*ECO2E

Indirect emissions of electricity consumption. Units: g CO2/Year

INIT GAVIAS=324.318

Initial value. Units: ha

INIT IRRIG=359

Initial value. Units: ha

INIT RC=2.08421e+006

Initial reservoir capacity. Units: m3

INITIAL ETP=23735

Initial tourist equivalent population. Units: inhab

INITIAL factor evoGDP=1

Initial value. Units: Dmnl

INITIAL INMIG=7608

Initial value. Units: inhab/Year

inmigration=IF THEN ELSE(Time<1997,INITIAL INMIG, INITIAL INMIG*employ index*"GDPca inmig-S")

Immigration rate. Units: inhab/Year

IR gavias=0.2

Infiltration ratio in gavias. Units: m/Year

IR=0.062

Infiltration ratio from rainfall. Units: Dmnl

IRCONR=7000

Irrigation consumption ratio. Units: m3/(ha*Year)

IRLOSR=0.43

Irrigation loss ratio. Units: Dmnl

irrigat reinfiltrat=irrigation gross demand-irrigation net demand

Infiltration water volume from irrigation. Units: m3/Year

irrigation gross demand=irrigation net demand+(irrigation net demand*IRLOSR)

Gross demand for irrigation. Units: m3/Year

irrigation net demand=irrigation*IRCONR

Net demand for irrigation. Units: m3/Year

irrigation reus vol=reus vol*IRRIGREUSR

Reused irrigation water volume. Units: m3/Year

irrigation=INTEG (newirrig, INIT IRRIG)

Irrigated area. Units: ha

IRRIGREUSR=0

Irrigation water reused ratio. Units: Dmnl

ISLAND=0.18

Proportion of tourist arrived from other island of the Archipelago. Units: Dmnl

Kc=0.35

Cereal coefficient. Insensitive parameters. Removing from the model structure after OAT. Units: Dmnl

km2=0.01

Change of units. Units: km2

Kn=23.5334

Egyptian vulture population carrying capacity natural, without considering the livestock effect. Units: ev

kwh flights=energy used flights*UDkwh MJ

Primary energy (kwh/y) from flights. Units: kwh/Year

kwh ships=SFCF desglosado*ships*UD kg fuel MJ*UDkwh MJ

Fuel used by ships. Units: kwh/Year

landscape indicator=(nat high quality +active gavias)/artificial land

Landscape indicator. Units: Dmnl

LGCC=EFLGCC+Kn

Increas on the Egyptian vulture carriying capacity because of the effect of livestock. Units: ev

lookup beach pc=([(0,0)-(100,1)],(0,0.1),(0.13333,0.2),(0.2,0.5),(1,1))

Source: Different scientific literature and expert (pers. com). Units: Dmnl

loss HP=loss HPHtracks+loss HPHroads+loss HPHbu-chHPHpermabandon

Change on the primary habitat. Units: ha/Year

loss HPHbu=effect new built up urb*HCRub*HPH prop

Houbara Primary Habitat Loss due to built urban. Units: ha/Year

loss HPHroads=new roads*HPHLRroads

Loss on the primary habitat due to the construction of roads. Units: ha/Year

loss HPHtracks=new tracks*HPHLRntracks

Loss on the primary habitat due to the construction of tracks. Units: ha/Year

loss HSHbu=effect new built up urb*HCRub*HSH prop

Loss on the secondary habitat due to urban areas.Units: ha/Year

loss HSHroads=new roads*HSHLRroads

Loss on the secondary habitat due to the construction of roads. Units: ha/Year

loss HSHtracks=new tracks*HSHLRntracks

Loss on the secondary habitat due to the construction of roads. Units: ha/Year

loss water rpop=rpop net demand*LOSS

Losses in water consumption by resident population. Units: m3/Year

loss water tur=tur net demand*LOSS

Losses in water consumption by tourist population. Units: m3/Year

LOSS=0.31

Loss ratio for urban water supply. Units: Dmnl

LUg=0.15

Livestock unit factor (1 goat= 0.15 LU). Units: LU/head

maturity factor=IF THEN ELSE(rem new accommod>=MATURITY THRESHOLD, MAX MATURITY FACTOR, rem new accommod/MATURITY THRESHOLD)

Maturity factor. Units: Dmnl

MATURITY THRESHOLD=0.1

Maturity threshold. For scenario simulation. Units: Dmnl

MAX ACCOMMODATION=133000

Maximum number of beds. Units: bed

MAX GAVIAS=800

Historical maximun of gavias area (Perdomo). Units: ha

MAX MATURITY FACTOR=1

Units: Dmnl

MF GDPca INMIG=1.24816

Effect of the GDPca on immigration (AC). Units: Dmnl

MFACTOR GDP=3.14604

Effect of the GDPreal on foreign tourists arrivals (AC). Units: Dmnl

MFACTOR IET=0.704086

Factor on the tourist choice index (AC). Units: Dmnl

MIR=0.609399

Maximum or intrinsic growth ratio for the Egyptian vulture (AC). Units: 1/Year

MOR=0.0036523

Mortality ratio. Units: 1/Year

n bov

Number of bovine heads until 2011 (Data). Units: head/Year

n bov2025=IF THEN ELSE(Time<2012, n bov,bov2012)

Number of cows until 2025 (for scenarios). Units: head

n goatsh2012=INTEG (goatsh rate,124373)

Number of goat after 2012 (for scenarios). Units: head

n goatsh 2025=IF THEN ELSE(Time<2012, goat and sheep cattle, n goats2012)

Number of goats and sheeps until 2025 (for scenarios). Units: head

n porc

Number of porcine heads until 2011 (Data). Units: head/Year

n porc2025=IF THEN ELSE(Time<2012, n porc, porcino2012)

Number of pigs until 2025 (for scenarios). Units: head

nat high quality=nat hq notrans+nat hq trans

Total high quality vegetation. Units: ha

nat hq golf=golf land demand*nat1

Change rate: from transformable high quality natural to golf. Units: ha/Year

nat hq hot=hot land demand*nat1

Change rate: from transformable high quality natural to hotel accommodations. Units: ha/Year

nat hq nonhot=nonhot land demand*nat1

Change rate: from transformable high quality natural to nonhotel accommodations. Units: ha/Year

nat hq notrans=INTEG (recovery nthq-degradation hq notrans,NATHQNTIN)

Area occupied by high quality vegetation (protected, so non transformable). Units: ha

nat hq prop=nat high quality /natural total

Units: Dmnl

nat hq res=res land demand*nat1

Change rate: from transformable high quality natural to residential. Units: ha/Year

nat hq roads=nat1*ha roads

Change from high quality transformable to roads rate. Units: ha/Year

nat hq tracks=ha tracks*nat1

Change from high quality transformable to tracks rate. Units: ha/Year

nat hq trans=INTEG (recovery thq-degradation hq trans-nat hq nonhot-nat hq golf-nat hq hot-nat hq res-nat hq tracks-nat hq roads,NATHQTIN)

Area occupied by high quality vegetation (transformable, so non protected). Units: ha

nat lq golf=golf land demand*nat2

Change rate: from transformable low quality natural to golf courses. Units: ha/Year

nat lq hot=hot land demand*nat2

Change rate: from transformable low quality natural to hotel accommodations. Units: ha/Year

nat lq nonhot=nonhot land demand*nat2

Change rate: from transformable low quality natural to nonhotel accommodations. Units: ha/Year

nat lq res=res land demand*nat2

Change rate: from transformable low quality natural to residential. Units: ha/Year

nat lq roads=ha roads*nat2

Change from low quality transformable to roads rate. Units: ha/Year

nat lq tracks=ha tracks*nat2

Change from low quality transformable to tracks rate. Units: ha/Year

nat lq=INTEG (permanent abandonment+degradation hq notrans+degradation hq trans-nat lq nonhot-nat lq golf-nat lq hot-nat lq res-recovery nthq-recovery thq-nat lq roads-nat lq tracks,NATLQIN)

Area occupied by low quality vegetation (actual vegetation). Units: ha

nat1=nat hq trans/natural trans

Proportion of the transformable high quality natural vegetation respect to the total transformable natural vegetation. Units: Dmnl

nat2=nat lq/natural trans

Proportion of the low quality natural vegetation respect to the total transformable natural vegetation. Units: Dmnl

NATACIN=NATHQNTIN+NATHQTIN

Initial value. Units: ha

NATHQNTIN=11529.9

Initial value. Units: ha

NATHQTIN=4143.07

Initial value. Units: ha

NATIN=153763

Initial value of the total natural vegetation. Units: ha

NATLQIN=138089

Initial value. Units: ha

natural landscape indicator=natural total/NATIN

Indicator of the naturality of the landscape. Units: Dmnl

natural total=nat high quality+nat lq

Area covered by natural vegetation. Units: ha

natural trans=nat hq trans+nat lq

All the transformable natural vegetation. Units: ha

NBEACH THRESHOLD=30

Normalized beach factor threshold (PTEOTIF, 2007). Units: m2/inhab

NEEevolution=(NEEfactor+preFACTOR*LN(rainfall))

NEE evolution derives from a linear regresion from literature review. Units: gCO2/(Year*ha)

NEEfactor=1.13987e+007

Net ecosystem exchange factor. Units: g CO2/(Year*ha)

net migration rate=(inmigration-emigration)/(inmigration+emigration)

Net migration indicator. Units: Dmnl

new built urban=nat hq nonhot+nat hq golf+nat hq hot+nat hq res+nat lq nonhot+nat lq golf+nat lq hot+nat lq res

New built up urban. Units: ha/Year

new built urban=nat hq nonhot+nat hq golf+nat hq hot+nat hq res+nat lq nonhot+nat lq golf+nat lq hot+nat lq res

New built up urban. Units: ha/Year

new roads=MAX(0, ROADSn*inc pop)

New roads demand. Units: km/Year

new tracks=MAX(0, inc pobres*TRACKSn)

New tracks demand. Units: km/Year

newirrig=abandoned gavias*ICR

Transformation of abandoned gavias into new irrigated lands. Units: ha/Year

NGP=0.5

Net grazing proportion. Units: Dmnl

no tend=0

For scenarios implementation. Units: Dmnl

nonat death Ev=real electrocution+poisoning

Non natural deaths of Egyptian vultures (poisoning and other non natural causes). Units: ev/Year

NONHOT ACCOM RATIO=0.53

Nonhotel accommodations ratio regarding the total tourist accommodation (Source: ISTAC 2012). Units: 1/Year

nonhot land demand=MAX(0,change nonhot*NONHOTEL ACCOMMODATION LAND DEM)

Units: ha/Year

NONHOTEL ACCOMMODATION LAND DEM=0.0042

Demand of land by each nonhotel accommodation bed. Units: ha/bed

nonhotel accommodation=tourist accommodation capacity*NONHOT ACCOM RATIO

Non hotel accommodation capacity. Units: bed/Year

nonhoteland=INTEG (nat hq nonhot+nat lq nonhot, 86.9242)

Units: ha

NORMAL EMPLOY FACTOR=1

When there are no changes on the employment, the index will be the normal value. Units: Dmnl

NOTOURIST EMPLOY=0.249

Proportion of employment not linked to tourist. Insensitive parameter. Removing from the model structure after OAT. Units: Dmnl

nthq prop=nat hq notrans/nat high quality

Proportion of the non transformable high quality natural vegetation respect to the total high quality natural vegetation. Units: Dmnl

occupancy rate=etp/tourist accommodation capacity

Tourist occupancy rate. Units: inhab/bed

or-1=DELAY FIXED (occupancy rate, 1, 0.68)

Delay in the occupancy ratio. Units: inhab/bed

or-2=DELAY FIXED (occupancy rate, 2, 0.7)

Delay of 2 years in the occupancy ratio. Units: inhab/bed

overgrazing indicator=(CGcpast/ grazeable area)/stocking rate max

Overgrazing indicator. Units: Dmnl

OVERGRAZING RATIO=1

Time unit. Units: 1/Year

p deficit hq=DELAY1(deficit hq, TES)

Effect of the deficit of hectares of high quality natural vegetation required by the grazing needs in the time. Units: ha

pasture and fodder production=FODDER YIELD*productive gavias

Units: kg/Year

peg=IF THEN ELSE(PGG=1,PEGcpl,PEGspl)

Probability of electrocution. Units: 1/(km*Year)

PEGcpl=2.425e-005

Probability of electrocution with corrective measures in power lines. Units: 1/(km*Year)

PEGspl=9.7e-005

Probability of electrocution without corrective measures in power lines. Units: 1/(km*Year)

PENINSULA=0.078

Proportion of tourist arrived from the Iberian Peninsula. Units: Dmnl

permanent abandonment=abandoned gavias/ST

Permanent abandonment (from abandoned gavias). Units: ha/Year

pg reus vol=tur treat vol-golf reus vol

Reuse water volumen destined to irrigation of parks and gardens. Units: m3/Year

PGG=STEP(1, 2006)

Corrective measures plan agains electrocution. Units: Dmnl

Photovoltaic energy

Data. Units: kwh/Year

pig rate=344.5

Change on the number of pigs rate. Units: head/Year

pimary E others=demand E others*energy losses

Primary energy demand from other sectors. Units: kwh/Year

plan rehab

Rehabilitation Plan (Data). Units: ha/Year

pli=resident population*PLRpc

Length of power lines. Units: km

PLRpc=0.00335

Power lines Ratio per capita. Units: km/inhab

pobres ret-1=DELAY FIXED (respop delay, 1, 41477)

Delayed resident population (in 1994). Units: inhab

POBRESINIT=42938

Initial value. Units: inhab

poisoning

Egyptian vultures deaths caused by poisoning (Data). Units: ev/Year

pop density=total population/FV area ha

Population density indicator. Units: inhab/ha

porc demand=n porc*TCONPORC

Water demand by by porcine cattle. Units: m3/Year

porcine2012=INTEG (pig rate, 6636)

Number of pigs after 2012 (for scenarios).Units: head

pot emigration=(resident population*TEXIT)*NOTOURIST EMPLOY

Potential emigration. Units: inhab/Year

potential accomodat effect=tourist accommodation capacity/REFERENCE ACCOMMOD

Units: Dmnl

potential electrocution=peg*pli*Egyptian vultures

Number of potential Egyptian vultures died by electrocution. Units: ev/Year

potential feedlot cattle feed=MAX(pasture and fodder production-fodder consumption supplied by grazing,0)

Potential feedlot cattle feeding. Units: kg/Year

potential new active gavias=IF THEN ELSE(productive gavias<active gavias, 0, MAX(riegavmax-active gavias,0))

Potential restored gavias. Units: ha

potential stocking rate reduction=IF THEN ELSE(SAp32=0, 0, cgfodproduction*LUg)

Potential stocking rate reduction thanks to measures implementation. Units: LU

pre mm

Rainfall (mm). Data. Units: mm

pre vol m2=FC pre*rainfall

Rainfall (m2). Units: m/Year

pre vol=pre vol m2*FV sur m

Annual rainfall (m3/year). Units: m3/Year

pre2011=pre mm

Rainfall until 2011. Units: mm

pre2012=IF THEN ELSE(CLIM=0, pre mm, pre mm*efec clim)

Rainfall after 2011 (for scenarios). Units: mm

preFACTOR=-2.25604e+006

Rainfall factor on the NEE. Units: (g CO2)/(Year*ha*mm)

pri energy navegation=(kwh flights+kwh ships)*TPP

Primary energy from navegation (flights and ships). Units: kwh/Year

pri energy transport=demand E transport*TPP

Primary energy from transportation (by road). Units: kwh/Year

pri nonel etp=demand nonel etp*TPP

Primary non electric energy from tourist equivalent population. Units: kwh/Year

pri nonel others=demand nonel others*TPP

Primary non electric energy from tourist equivalent population. Units: kwh/Year

pri nonel respop=demand nonel respop*TPP

Primary non electric energy from resident population. Units: kwh/Year

pri pop and transp=pri tot population+pri energy transport

Total primary energy from the population and transportation. Units: kwh/Year

pri tot others=pimary E others+pri nonel others

Total primary energy from other sectors. Units: kwh/Year

pri tot population=primary E respop+pri nonel respop+primary E etp+pri nonel etp

Total primary energy from the population. Units: kwh/Year

primary E desalation=demand E des*energy losses

Primary energy demand for desalination processess. Units: kwh/Year

primary E etp=demand E etp*energy losses

Primary energy from tourist equivalent population. Units: kwh/Year

primary E respop=demand E respop*energy losses

Primary energy from resident population. Units: kwh/Year

primary habitat=INTEG (-loss HP, HPHinicial)

Primary habitat of the houbara. Units: ha

productive gavias=MIN(active gavias,riegavmax)

Productive gavias. Units: ha

ptotFACTOR=0.0003261

Effect of the total population on the ship navigation. Units: ships/inhab

rainfall recharge=pre vol*IR

Groundwater recharge from rainfall. Units: m3/Year

rainfall=IF THEN ELSE(Time<2012, pre2011,pre2012)

Rainfall (long serie). Units: mm

Ratio between tourist accommodation and resident population=(tourist accommodation capacity/resident population)*100

Ratio between tourist accommodation and resident population. Units: bed/inhab

RATIO ha km ROADS=1

Roads width (10 m). Units: ha/km

RATIO ha km TRACKS=0.4

Tracks width (4 m). Units: ha/km

ratioG=0.61

Proportion of German tourist from the total foreing tourists arrived to Fuerteventura. Units: Dmnl

ratioUK=0.38

Proportion of German tourist from the total foreing tourists arrived to Fuerteventura. Units: Dmnl

real electrocution=potential electrocution+RANDOM NORMAL(0,6, 0, 1,7)

Number of real Egyptian vultures died by electrocution. Units: ev/Year

real stocking rate reduction=MIN(CGc,potential stocking rate reduction)

Real stocking rate reduction. Units: LU

recovery nthq=(nat lq/RT)*nthq prop

Recovery rate to non transformable high quality natural vegetation. Units: ha/Year

recovery thq=(nat lq/RT)*thq prop

Recovery rate to transformable high quality natural vegetation. Units: ha/Year

recup gavia reu=0

For scenarios implementation. Units: Dmnl

recycled waste=waste mixed*TRECRES

Extracted wastes from the mix to be recycled. Units: kg/Year

reduction of grazing=potential stocking rate reduction/LUg*TINGCAPROV

Reduction of consumption removed of the grazing. Units: kg/Year

REF Egyptian vult=190

Reference value in 2009 (Source: Mallo and Díez 2010). Units: ev

REF houb habitat=29633

Reference data (2002). Units: ha

REFERENCE ACCOMOD=30379

Reference value (in this case, the initial value). Units: bed

REFERENCE EMPLOYMENT=8549

Reference value. Units: emp

rehab efec=IF THEN ELSE(Time<2011,plan rehab, rehab2011)

Rehabilitation effect. Units: ha/Year

rehab2011=SAgr*efect reut

Gavias rehabilitation from 2011, for scenarios implementation. Units: ha/Year

rem new accommod=(MAX ACCOMMODATION-tourist accommodation capacity)/(MAX ACCOMMODATION)

Remanents new accommodation beds. Units: Dmnl

renewable E production=IF THEN ELSE(SAwr=0,TI Eeolica+Photovoltaic energy+Thermal energy, Wind energy+Photovoltaic energy+Thermal energy+demand E des)

Renewable energy production. Units: kwh/Year

requiered energy fodder scn=fodder desalinated water supply*TKWM3

Requiered energy to supply the desalinated water demand for fodder scenario. Units: kwh/Year

requiered fodder bovporc=fod consump porc+fod consump bov

Total requiered fodder for cattle herd (cow+ pig). Units: kg/Year

requiered fodder caprov=TINGCAPROV*goat and sheep cattle

Fodder consumption (and other materials) by goat and sheep cattle. Units: kg/Year

RErpop=RAMP(-0.31, 2012, 2025)

For scenario analysis. Recession efect on water consumption of resident population (the proportion of decrease between 2008-2011). Units: m3/(Year*inhab)

res land demand=MAX(inc pobres*TSUCVOpc, 0)

Residential and other uses land demand. Units: ha/Year

reservoir capacity=INTEG (-filling rate,INIT RC)

Reservoir capacity. Units: m3

resident population=INTEG (inmigration+births-deaths-emigration, POBRESINIT)

Units: inhab

residential=INTEG (nat hq res+nat lq res,2465.33)

Area occupied by residential uses. Units: ha

respop delay=DELAY FIXED (resident population,1,42882)

Resident population one year delayed (in 1995: 42882 inhabitants). Units: inhab

respop treat vol=RPTREATMENTP*rpop sewage vol

Treated water from resident population sewage water. Units: m3/Year

reus vol=REUSR*respop treat vol

Volume of reusing urban reclaimed water. Units: m3/Year

REUSR=0.35

Ratio of reusing urban reclaimed water. Units: Dmnl

riegavmax=water total crop/DOTRPAST

Maximun active gavias area that we can irrigate with the available water. Units: ha

road network density=(roads/(FV sur ha*km2))
Road network density. Units: km/km2
roads area= INTEG (nat hq roads+nat lq roads,ROADSin)
Area occupied by roads. Units: ha
roads=(roads area)/RATIO ha km ROADS
Length of roads. Units: km
ROADSin=423.205
Initial value. Units: ha
ROADSn=0.000358
New roads demand ratio. Units: km/inhab/Year
rpop desal demand=rpop gross demand*RPOP DESAL DEM
Desalinated water demand by resident population. Units: m3/Year
rpop desal gw ratio=TOT DEMAND-RPOPAQUIFR
Residential population desalinated water demand ratio. Units: Dmnl
rpop gross demand=loss water rpop+rpop net demand
Gross water demand by resident population. Units: m3/Year
rpop net demand=resident population*rpopconr
Net water demand by resident population. Units: m3/Year
rpop sewage vol=rpop net demand*RPSEWAGEPROP
Residential population sewage water volume. Units: m3/Year
RPOPAQUIFR=0.01
Popula tion Water demand from the aquifer (ratio). Units: Dmnl
rpopconr= IF THEN ELSE(SAer=0, RPOPCONRbase,RPOPCONRbase+RErpop)
Residential population water consumption. Units: m3/(inhab*Year)
RPOPCONRbase=65.7
Residential population water consumption ratio. Units: m3/(Year*inhab)
RPSEWAGEPROP=0.6
Sewage proportion. Units: Dmnl
RPTREATMENTP=0.91
Treatment water proportion from resident population. Units: Dmnl
RT=136.754
Average time of plant composition recovery. Units: Year
runoff=RUNOFFcte*pre vol
Annual runoff volume. Units: m3/Year
RUNOFFcte=0.026
Runoff factor. Units: Dmnl
SAer=0
Scenario activator (economic recession). Units: Dmnl
SAfod=0
Scenario fodder production on the island activator. Units: Dmnl
SAgr=0
Scenario gavias reuse activator. Units: Dmnl
SAp3=IF THEN ELSE(SAfod=1, SAfod, SAgr)
Scenario Activator for measure M.3. Units: Dmnl
SAp32=0
Scenario activator for Measure 3.2. Units: Dmnl
SAwr=0
Scenario Activator: renowable production of desalinated water. Units: Dmnl
SCG=44
Area occupied by each golf course. Units: ha/golf course
scn spill=1-spill*STEP(1,2015)+spill*0.1111*RAMP(0.1, 2018,2025)
Units: Dmnl

SCO2E=3200

Ships CO2 Emission Factor. Units: g CO2/kg fuel

SEADES CONVR=0.45

Seawater desalination conversion ratio (Source: Meerganz von Medeazza et al. 2007; Pérez-González et al. 2012). Units: Dmnl

SEADESCAP=2.757e+007

Seawater desalination capacity. Insensitive parameters. Removed from the model structure after OAT. Units: m3/Year

secondary habitat=INTEG (-change HS, HSHinicial)

Secondary habitat of the houbara. Units: ha

selective waste collection=total population*TRECSELEC

Selective collection of the urban solid waste. Units: kg/Year

SEWAGE PROP TUR=0.57

Proportion of sewage water from tourist consumption (Source: CIAGC 2011). Units: Dmnl

SFACTOR=691.1

Ships factor. Intercept ships. By linear regression. Units: ships

SFCF desglosado=FUEL CONSs*DIST4*(goods/shipCAPACITY)

Units: kg fuel/(Year*ships)

share of renewable energy=energy self sufficient index*100

Share of renewable energy. Units: Dmnl

shipCAPACITY=2.56617e+009

Carriying capacity at 55% of the GT. Units: kg/ships

ships=SFACTOR+GDPcaFACTOR*GDPca long+ptotFACTOR*total population

Units: ships

SHOCK ARAB SPRING=RAMP(0.11, 2010 , 2011)+RAMP(-0.0367, 2011, 2014)

Arab Spring effect (Canalis 2013). Units: Dmnl

SHOCK NORMAL=1

Normalised shock. Units: Dmnl

SHOCKS=SHOCK NORMAL+SHOCK ARAB SPRING

Benchmarks. Units: Dmnl

spill=0

For future scnearios of a spill. Units: Dmnl

ST=79

Period of succession after the abandonment of agricultural areas. Units: Year

stocking rate max=CPRE*rainfall

Maximum stocking rate capacity. Units: LU/ha

surface discharge=IF THEN ELSE((surface water*TEXIT)<irrigation gross demand, (surface water*TEXIT), irrigation gross demand)

Surface discharge. Units: m3/Year

surface recharge=IF THEN ELSE(adjustable runoff<(reservoir capacity*TEXIT), adjustable runoff, (reservoir capacity*TEXIT))

Surface recharge. Units: m3/Year

SURFACE WATER INIT=2.6e+006

Initial value. Units: m3

surface water=INTEG (surface recharge-surface discharge,SURFACE WATER INIT)

Surface water volume. Units: m3

TCEO=0.254

Electric energy consumption ratio by other sectors. Units: Dmnl

TCEOne=0.27

Non electric energy consumption ratio by other sectors. Units: Dmnl

TCNE=333.302

Non electric consumption ratio by resident population. Units: kwh/(inhab*Year)

TCONBOV=17.3

Water consumption by each head of livestock (cows). Insensitive parameters. Removing from the model structure after OAT. Units: m3/head

TCONCAPROV=1.825

Water consumption by each head of livestock (goats and sheeps). Units: m3/head

TCONPORC=2.87

Water consumption by each head of livestock (pigs). Units: m3/head

TCV=13816.1

Annual energy consumption ratio by each car. Units: kwh/(car*Year)

TEMIG BASE=0.084

Base emigration ratio. Units: 1/Year

temig=TEMIG BASE/employ index

Units: 1/Year

TER=0.36+RAMP(-0.06, 2009, 2010)

Touristic employment ratio.Units: emp/inhab

TES=6.40479

Time to detect the overgrazing effects (AC). Units: Year

TEXIT=1

Unit conversor. Units: 1/Year

TGEREURBpc=589.28

Urban waste generation per capita. Units: kg/(inhab*Year)

Thermal energy

Data. Units: kwh/Year

thq prop=nat hq trans/ nat high quality

Proportion of the transformable high quality natural vegetation respect to the total high quality natural vegetation. Units: Dmnl

THRESHOLD OR=0.530499

Profitability threshold for the occupancy rate.Units: inhab/bed

TINGBOV=16607.5

Fodder consumption by each head of livestock (cows). Insensitive parameters. Removing from the model structure after OAT. Units: kg/(head*Year)

TINGCAPROV=657

Fodder consumption by each head of livestock (goats and sheeps). Units: kg/(head*Year)

TINGPORC=1124.2

Fodder consumption by each head of livestock (pigs). Insensitive parameters. Removing from the model structure after OAT. Units: kg/(head*Year)

TINMIGDPca=2

Time of the effect of the GDPca on the inmigration (AC).Units: Year

TKWM3=4.5

Energy consumption for desalation. Units: kwh/m3

TKWM3=4.5

Energy consumption for desalation. Units: kwh/m3

tmot=effect chGDPca*TMOTN

Motorization index. Units: car/inhab

TMOTN=0.421658

Motorization index base (AC). Units: car/inhab

TOT DEMAND=1

Total water demand. Units: Dmnl

tot pri no renewab=tot prim energy-renewable E production

Total primary non renewable energy. Units: kwh/Year

tot prim energy=pri tot others+pri tot population+pri energy transport+primary E desalation+pri energy navigation

Total primary energy demand. Units: kwh/Year

tot recharge=gavias infiltration+irrigat reinfiltrat+rainfall recharge

The average recharge. Units: m3/Year

tot reus vol=golf reus vol+reus vol+pg reus vol

Total volume of reusing urban reclaimed water. Units: m3/Year

tot sewage vol=tur treat vol+respop treat vol

Total population sewage water volume. Units: m3/Year

total houbara habitat=primary habitat+secondary habitat

Total habitat of the houbara. Units: ha

total population=resident population+etp

Units: inhab

total water needs=DOTRPAST*SAfod*(fodder scn area+productive gavias)

Total water needs. Units: m3/Year

totEpri pc=tot prim energy/total population

Total primary energy per capita. Units: kwh/(Year*inhab)

tourist accommodation capacity=INTEG (accomodation ch,REFERENCE ACCOMOD)

Tourist accomodation capacity.Units: bed

tourist employment=etp*TER

Tourist employment.Units: emp

tourist price index

Tourist price index (Data). Units: Dmnl

TOURISTGOLFREUR=RAMP(0.6, 2002, 2003)

Reusing ratio of tourist recalimed water on golf courses. Units: Dmnl

tpi factor=tpi NORMAL-TPI long

Tourist prices index factor. Units: Dmnl

TPI long=IF THEN ELSE(Time<2012, tourist price index,tourist price index+TPI2012)

Long time series of TPI. Units: Dmnl

tpi NORMAL=1

Normalized tourist price index. Units: Dmnl

TPI2012=0

For scenarios activation. Units: Dmnl

TPP=1

Non electric energy loss ratio (from primary energy to final energy (Source: Government of Canary Islands 2006). Units: Dmnl

TRACKin=471.96

Initial value. Units: ha

tracks area=INTEG (nat hq tracks+nat lq tracks,TRACKin)

Area occupied by tracks. Units: ha

tracks=(tracks area)/RATIO ha km TRACKS

Length of tracks. Units: km

TRACKSn=0.001719

New tracks demand ratio. Units: km/(Year*inhab)

treated sewage proportion=tot sewage vol/urb sewage vol

Treated sewage proportion. Units: Dmnl

TRECRES=0.07

Recycled waste ratio from the mixture of waste. Units: Dmnl

TRECSELEC=49.57

Selective urban solid wastes collection ratio. Units: kg/(Year*inhab)

TREUG=0.2

Annual ratio for gavias recuperation. Units: 1/Year

TSUCVOpc=0.0743173

Built Urban and other uses per house ratio (AC). Units: ha/(inhab*Year)

tur gross demand=loss water tur+tur net demand

Gross water demand by tourist population. Units: m3/Year

tur net demand=etp*TURCONR
Net water demand by tourist population. Units: m3/Year
tur sewage vol=tur net demand*SEWAGE PROP TUR
Tourist sewage water volume. Units: m3/Year
tur treat vol=tur sewage vol*TUR TREAT
Treated water from tourist population sewage water. Units: m3/Year
TUR TREAT=1
Tourist water retreat ratio. Units: Dmnl
TURCONR=126.02
Tourist water consumption ratio. Units: m3/(inhab*Year)
tures=etp/resident population
Ratio of tourists to residents. Units: Dmnl
UD kg fuel MJ=40.5
Units change. Units: MJ/kg fuel
UDkwh MJ=0.277
Units change. Units: kwh/MJ
urb sewage vol=tur sewage vol+rpop sewage vol
Urban sewage water volume. Units: m3/Year
urban desal demand=rpop desal demand+tur gross demand
Urban desalination water demand. Units: m3/Year
urban gross demand=rpop gross demand+tur gross demand
Gross water demand by the population. Units: m3/Year
USW generation=total population*TGEREURBpc
Urban solid waste generation. Units: kg/Year
vehicles fleet=total population*tmot
Vehicles fleet. Units: car
vis1=ISLAND*visitors
Passengers arrived from other islands of the Canarian Archipielago. Units: inhab/Year
vis2=PENINSULA*visitors
Passengers arrived from the Iberian Peninsula. Units: inhab/Year
vis3=ABROAD*visitors
Passengers arrived from foreing countries. Units: inhab/Year
visitors=(etp/AVERSTAY)*DAYS A YEAR
Number of visitors arrived to Fuerteventura Island. Units: inhab/Year
VOL FLOW SEA=9e+006
Volume flowing into sea. Units: m3/Year
vol flow spring=50457.6
Volume flowing through spring. Before SA= groundwater*FLOWSPRINGR. Units: m3/Year
vol max reu=active gavias*DOTRPAST
Potential water volumen requiered by gavias. Units: m3/Year
waste managed in landfills=waste mixed-recycled waste
Units: kg/Year
waste mixed=USW generation-selective waste collection
Units: kg/Year
water total crop=(MAX(0,fodder desalinated water supply))+annual vol gav reuse
Total volumen of water requiered by active gavias. Units: m3/Year
WCO2E=2200
Waste CO2 Emission factor (Source: Castellani and Sala 2013). Units: g CO2/kg
Wind power
Data. Units: kwh/Year